in phraseology desirable in the proposed law to avoid ambiguity and uncertainty. To most clearly and intelligently express those proposed changes and the scope of the bill after they are made, your committee have embodied them in a substitute bill which they report herewith and respectfully recommend that it do pass.

A BILL to fix the standard of weights and measures by the adoption of the metric system of weights and measures.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That from and after the first day of July, eighteen hundred and ninety-eight, all the Departments of the Government of the United States, in transaction of all business requiring the use of weight and measurement, except in completing the survey of the public lands, shall employ and use only the weights and measures of the metric system.

SEC. 2. That from and after the first day of January, nineteen hundred and one, the metric system of weights and measures shall be the only legal system of weights and measures recognized in the United States.

SEC. 3. That the metric system of weights and measures herein referred to is that in which the ultimate standard of mass or weight is the international kilogram of the International Bureau of Weights and Measures, established in accordance with the convention of May twentieth, eighteen hundred and seventy-five, and the ultimate standard of length is the international meter of the same bureau, the national prototypes of which are kilogram numbered twenty and meter numbered twenty-seven, preserved in the archives of the office of standard weights and measures.

SEC. 4. That the tables in the schedules annexed to the bill authorizing the use of the metric system of weights and measures passed July twenty-eighth, eighteen hundred and sixty-six, shall be the tables of equivalents which may be lawfully used for computing, determining and expressing the customary weights and measures in the weights and measures of the metric system.

LETTER SENT ON MARCH 15, 1896, FROM THE OFFICE OF SECRETARY, AMERICAN METROLOGICAL SOCIETY, COLUMBIA UNIVERSITY, NEW YORK.

DEAR SIR: You are aware, no doubt, that the Committee on Coinage, Weights and Measures, of the House of Representatives, Hon. C. W. Stone, Chairman, has directed that a favorable report be made, to the House, of a bill making the use of the metric system obligatory in the United States after certain dates named in the bill. The bill reported is a substitute for the Hon. D. M. Hurley's bill. A copy of the substitute bill is enclosed.

It is very important that all interested in this bill should act promptly and vigorously.

If you are in favor of the bill sign the enclosed petition and obtain on it the signatures of friends in your neighborhood. Mail the signed petition, with a personal letter, as soon as practicable, to your Representatives in Washington, D. C. Kindly send the Society a postal card stating when you sent the petition and the number of names signed.

The Society would be glad to know the condition of feeling toward the metric system in your vicinity.

Yours respectfully,

B. A. GOULD,
President.
J. K. REES,
Secretary.

FORM OF PETITION.

The undersigned citizens residing in his Congressional District respectfully urge the Honorable Mr. ———— to consider favorably and vote for the bill reported to the House of Representatives by the Committee on Coinage, Weights and Measures, to fix the standard of weight and measures by the adoption of the metric system of weights and measures.

ON THE REFLECTION OF THE RÖNTGEN RAYS FROM PLATINUM.

THE interest connected with this subject led me on March the 9th to undertake a

set of experiments, and indications were almost immediately obtained that a small percentage of the so-called X-rays were reflected by a platinum surface placed at an angle of forty-five degrees. The exposure of the sensitive plate, however, was not sufficiently prolonged; neither was it properly shielded from the anode end of the discharge tube. Matters were finally arranged so that the plate-holder was completely shielded from all parts the discharge tube by screens of heavy sheet lead, and on March 13th, after an exposure of ten hours, a satisfactory negative was obtained, capable of furnishing prints.

The apparatus employed was of the simplest character; a coil of moderate size, made by Ruhmkorff more than thirty years ago, was excited by a current suitable for class-room experiments, no condenser whatever being employed. The Crookes' tube was of German make, and had originally been intended only for class demonstrations. With aid of a fluorescent screen it had been carefully studied, and the best portion of it was employed. The reflecting surface consisted of a new sheet of ordinary platinum foil, which was held rather loosely against a plate of glass, no attempt being made to remove its accidental deformations, which were mainly paralleled to the axis of the cylinder, which it had formed when rolled on its stick. These elongated deformations, convex and concave, were placed vertically.

The plate holder, in addition to its draw slide, was completely covered by a plate of aluminium with a thickness of 0.17 mm.; the central horizontal portion of this was again covered by a broad strip of the same aluminium plate, and over the whole was fastened a netting of iron wire, destined to furnish the image. I may remark in passing that I have found wire netting very useful in other experiments with the X-rays, as it gives instant information as to the condition of the field with regard to uniformity of illumination, single or double sources of the rays, and also with regard to the relative transparency of objects placed on the plate holder.

The plate holder being arranged as indicated, care was taken that rectilinear emanations from the discharge tube should not even reach the external wooden portions of its frame.

After an exposure of ten hours it was found that a good image of the netting had been produced on the vertical strip of the plate exposed to the reflected rays. This image had various deformations, the vertical lines representing the netting being as a general thing most distinct; in some places, however, the horizontal lines had the upper hand, and there were a few spots where both were equally distinct. The image under those portions protected by two thicknesses of aluminium plate was perhaps a trifle fainter than that on the rest of the plate. These facts and the character of the deformations point very strongly to the conclusion that in the act of reflection from a metallic surface the Röntgen rays behave like ordinary light.

Photographic experiments were then made to ascertain the percentage of the rays reflected. A plate from the same box was placed at a corresponding distance (6.5 inches) from the discharge tube, and the exposure diminished, till a similar image was obtained. It was, of course, protected in the same way as in the experiment on reflection, and developed for the same length of time. This image was not in any way deformed. After an examination of it by Mr. F. J. Harrison, Professor Hallock and myself, the conclusion was reached that the reflected image had the same intensity. This would indicate that platinum foil reflects the $\frac{1}{260}$ part of the X-rays incident on it at an angle of 45°. Of course this figure is to be regarded as a first approximation.

In conclusion, I may add that the great-

est care was taken to obtain the most sensitive plates and the most powerful developer known, and that this matter gave much more trouble than the experiment just described. OGDEN N. ROOD.

COLUMBIA UNIVERSITY, NEW YORK.

FURTHER EXPERIMENTS WITH X-RAYS.

PHOTOGRAPHS have now been obtained with several of the Crookes tubes in the cabinet of the Dartmouth Laboratory, but the one referred to in a previous communication is by far the most efficient, and it has been used in nearly all the experiments now to be described. This tube was made by Stoehrer, of Leipzig, being No. 1147 of his catalogue, where it is designated as Puluj's neue Phosphorescenz-Lampe. It contains a mica diaphragm coated with some phosphorescent substance, and gives quite a brilliant green light when in action (although this brilliancy is doubtless immaterial to the production of the X-rays).

As to the source of the X-rays developed by this tube it may be stated that a variety of experiments have shown that they originate in the diaphragm itself where exposed to the cathode rays, and not to any appreciable degree in the glass around the diaphragm. Cathode rays which pass through the diaphragm appear, however, to develop X-rays at the surface of the glass where they impinge.

The method first adopted for determining the position of the source was that of calculating its distance from the plate from the magnification of the shadows of intervening opaque objects, but this procedure brought out anomalies, as will presently be mentioned. By bringing the plate near the tube, the diaphragm could be made to cast its own shadow, and the resulting appearance leaves no doubt that the X-rays chiefly originate in a limited portion of the diaphragm. The method of using a series of parallel films leads to the same conclusion, and indicates that in this tube the rays do not proceed directly from the cathode itself.

Lenard has observed that the cathode rays are diffracted around the edges of obstacles. In case of the X-rays our experiments indicate an effect apparently somewhat the reverse of this. While the shadow of an obstacle is always magnified, and often to a degree disproportionate to the distances involved, we have obtained several plates showing the impression from an aperture in an opaque object to be slightly minified, when the plate is sufficiently near the object. This would point to an outward rather than an inward bending of the rays. In this connection attention is called to a curious phenomenon presenting to the eye the appearance of irradiation, although it is difficult to believe that any real analogy to irradiation is offered.

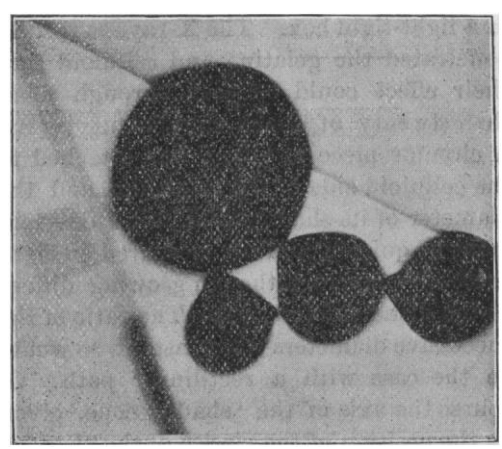

FIG. 1. DISTORTION OF COINS PHOTOGRAPHED WITH X-RAYS.

The coins shown in Fig. 1, are a silver dollar, a dime, and two nickels, in contact, all perfectly round; a glass rod (ending in a brass cap) touches the dollar, and a small piece of hard rubber prevents it from rolling. The line across the plate, through the shadow of the dollar, is the image of the mica diaphragm, the plane of which was nearly perpendicular to the